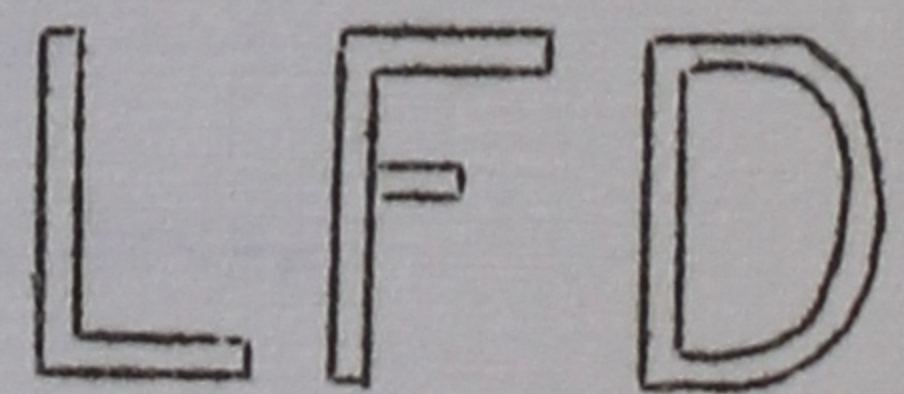
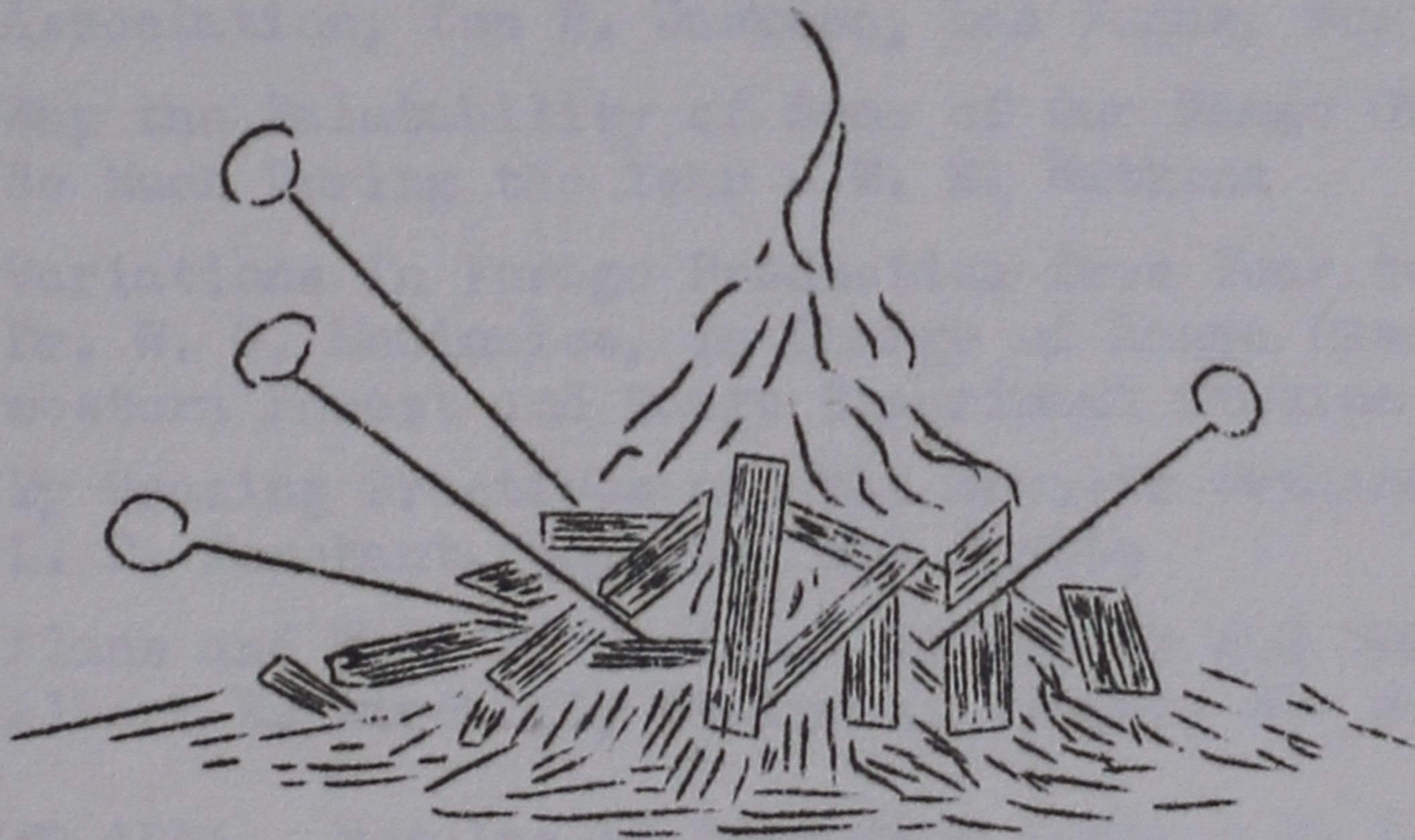
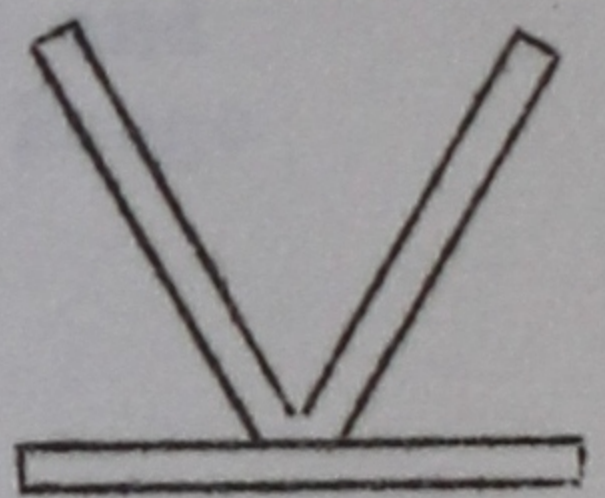
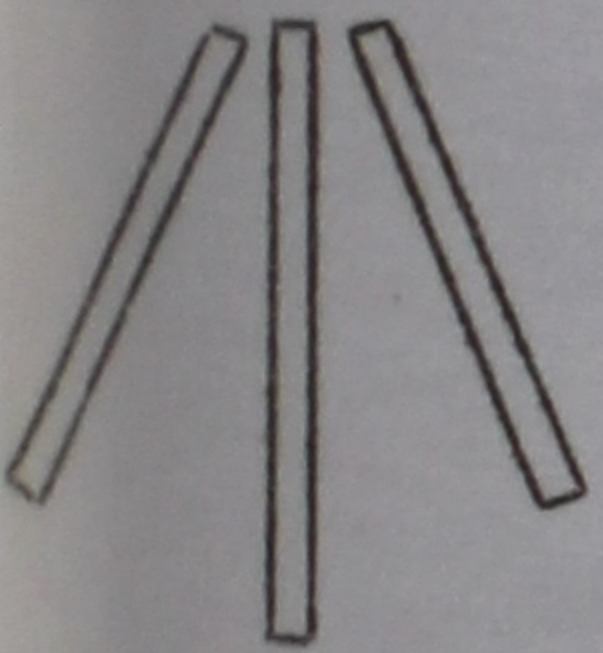
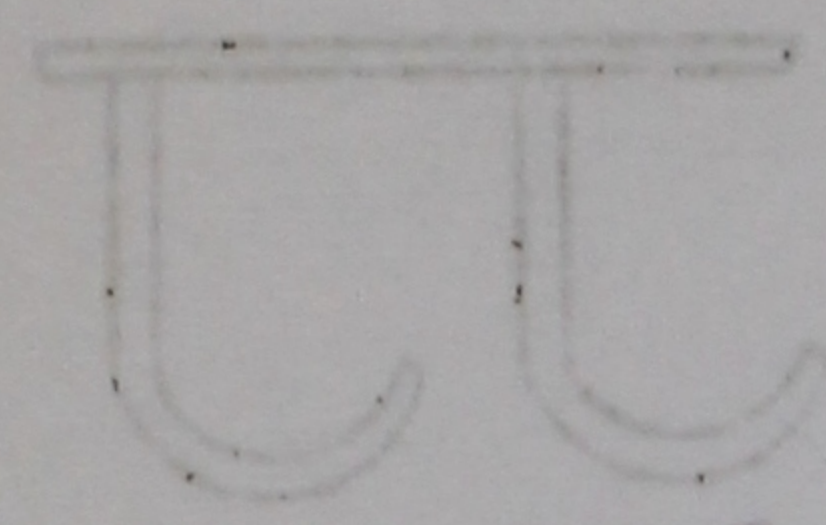


EXPERIMENTAL RANCH



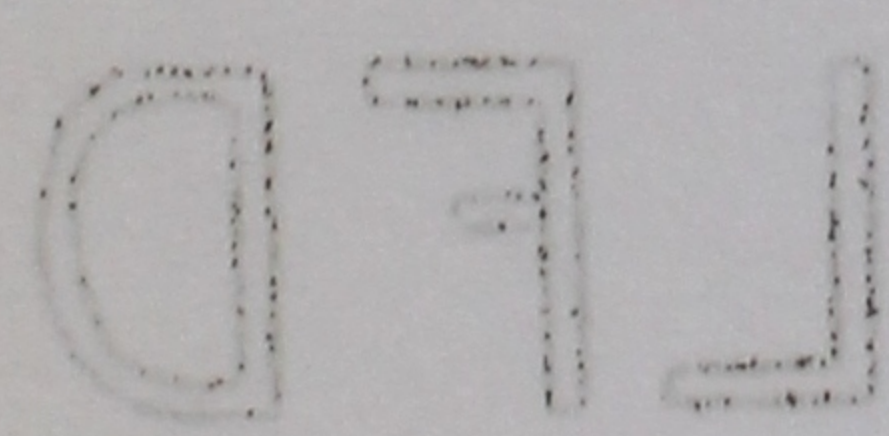
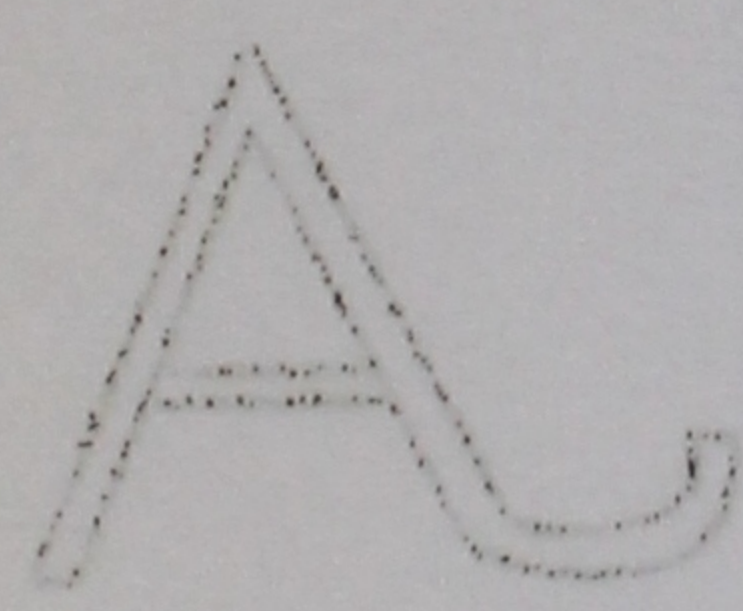
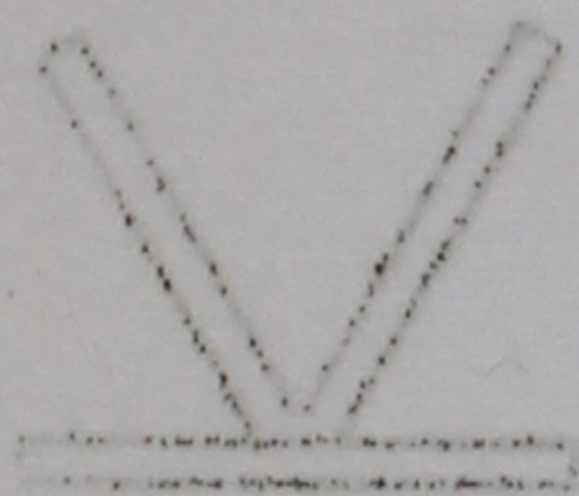
OCTOBER 14, 1940

NEW MEXICO EXPERIMENT STATION, NEW MEXICO EXTENSION SERVICE
U. S. FOREST SERVICE



RANCH DAY

EXPERIMENTAL RANCH



OCTOBER 11, 1940

NEW MEXICO EXPERIMENT STATION, NEW MEXICO EXPERIMENT SERVICE
U. S. FOREST SERVICE

P R O G R A M

George Ellis, Extension Animal Husbandman, Presiding

LEAVE LAS CRUCES 7:30 A.M.

LEAVE RADIUM SPRINGS 8:05 A.M.

8:25 MAYFIELD WELL. Benefits of Maintaining a Good Range Cover -
J. O. Bridges

9:10 SELDEN WELL. Making the Rate of Stocking More Flexible -
P. E. Neale

9:50 OLD RODENT PLOT. Rodents as a Factor in the Revegetation of
Badly Depleted Ranges - J. O. Bridges

10:35 SPREADERS. Water-spreading Structures in Relation to Range
Management Practices - R. A. Young, Area Conservation-
ist, U. S. Soil Conservation Service

HEADQUARTERS (See the exhibits on display here)

11:15 Judging of range bulls by attending ranchmen. Discussion
of the selection of range bulls - Leader, Geo. H. Cureton,
Lordsburg, New Mexico

11:50 Lunch

12:40 Welcome by H. M. Milton, II, President of the College, and
Arthur Upson, Director of the Southwestern Forest and Range
Experiment Station

12:55 Remarks by President of New Mexico Cattle Growers'
Association, Con W. Jackson, Las Vegas, New Mexico

1:05 Why the Palatability of Some of Our Range Grasses Fluctuates
So Much During the Year - W. E. Watkins

1:20 Variations in Forage Production from Year to Year -
Dr. W. G. McGinnies, In Charge of Range Research, South-
western Forest and Range Experiment Station

1:40 My Grazing Practices and the Results Obtained -
L. D. Merchant, Capitan, New Mexico

1:55 Plans and Work of National Livestock and Meat Board -
Albert K. Mitchell, Chairman, Albert, New Mexico

2:25 RESEEDING AREA. Results of Reseeding Tests - J. O. Bridges

3:05 CAMP WELL. Recent Tests on the Effect of Phosphorus Supplemonts
on the Production of Range Cows - J. H. Knox

3:45 CO-OP WELL. Range Managment and Preservation - Fred N. Aros,
Superintendent Jornada Experimental Range

4:05 Tour of the Jornada Experimental Range

EXPERIMENTAL RANCH

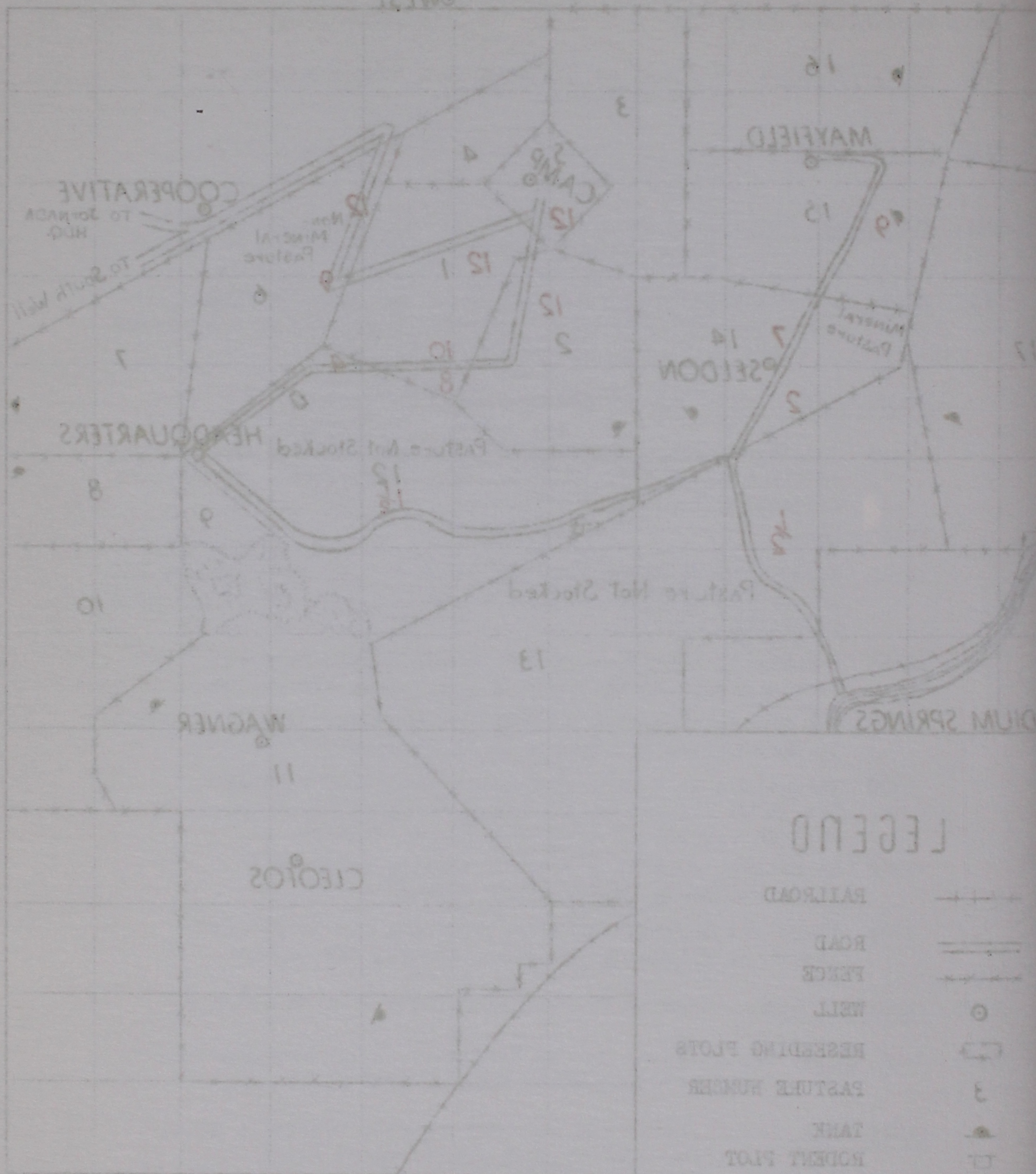


Figures in red represent the estimated carrying capacity. Where there is only one figure in a pasture it represents an average for that portion of the pasture visible from the road. Where there are two figures in a pasture each represents the carrying capacity for the portion of the pasture in which it is located.

Road on map shows route of tour.

EXPERIMENTAL RANCH

WEST



LEGEND

RAILROAD	---
ROAD	==
FENCE	- - -
WELL	o
RESERVING PLOTS	□
PASTURE NUMBER	1
TANK	●
ROBERT PLOT	■

Figures in red represent the estimated carrying capacity. Where there is only one figure in a pasture it represents an average for that portion of the pasture liable from the road. Where there are two figures in a pasture each represents the carrying capacity for the portion of the pasture in which it is located.

and on map shows route of tour.

BENEFITS OF MAINTAINING A GOOD RANGE COVER

J. O. Bridges

There have been 24 mature breeding cows in this pasture for the last three years. Being mature cows, they will average out better than the herd as a whole. Their average weight has been 1038 pounds. They have produced almost a 100-percent calf crop during the last three years; only one cow failed to calve one year. This is about 10 percent better than the average of the herd. The College Ranch uses a limited breeding season; the bulls are put in the latter part of May and removed the fore part of September. This makes the calves come from March to May, with the bulk of them being dropped in March. The calves are weaned between October 15 and November 1, making them seven to eight months old at this time. Those from this pasture have averaged 468 pounds at weaning time over the last three years.

This pasture which we are in contains slightly over four sections; the portion of the pasture which you have passed through supports the best grass in the pasture. There is about one section like this. It might be said to be almost as good a stand as we can expect under this rainfall, which is between $8\frac{1}{2}$ and 9 inches. Another two sections of the grass in this pasture is about three-fourths this good and the other section is very poor, being chiefly mesquite dunes and snakeweed. The pasture as a whole will rate about the average of the pastures being used on the ranch, but will rate at only three-fourths as good as our best pastures.

I should like to call your attention to the table. :

	Stocking A.U. per sec.	Percent calf crop	Calf weight	Calf wt. per breed- ing cow	Calf wt. produced per sec.	Cow wt. maintained per sec.
Pasture 15	6	99	468	463	2780	6000
College Ranch	6	90	450	405	2430	6000
*Average of 32 SE New Mexico ranches	16	79	354	280	4475	13000
Pasture 15 if stocked to full carrying capacity	9	99	468	463	4170	9000

* These are from actual records kept by ranchmen who are cooperating with the College in an economic study.

The first line of this table presents the actual results obtained in this pasture over the last three years. It is realized that this is better than one could expect from an entire herd in which the cows ranged in age from three to ten years old.

The second line gives the results for the College Ranch herd where the calf crop is 90 percent, the weight per section here being 350 pounds less. It is unfortunate that actual figures of production from a group of ranches located in a similar type of country and rainfall are not available, with which to compare the production of the College Ranch. The best it has been possible to do is to compare it with a group of 32 ranches located in southeastern New Mexico, where they receive from 5 to 8 inches more annual rain-

3.0. Bridges

There have been 21 native breeding cows in this pasture for the last three years. Being native cows, they will average out better than the herd as a whole. Their average weight has been 1058 pounds. They have produced almost a 100 percent calf crop during the last three years; only one cow failed to calve one year. This is about 10 percent better than the average of the herd. The College Ranch uses a limited breeding season; the bulls are put in the latter part of May and removed the first part of September. This makes the calves come from March to May, with the bulk of them being dropped in March. The calves are weaned between October 15 and November 1, making them seven to eight months old at this time. Those from this pasture have averaged 148 pounds at weaning time over the last three years.

This pasture which we are in explains why it is so good. The section of the pasture which you have passed through supports the best grass in the pasture. There is about one section like this. It might be said to be almost as good a stand as we can expect under this rainfall, which is between 24 and 28 inches. Another two sections of the grass in this pasture is about three-fourths this good and the other section is very poor, being chiefly mesquite brush and brushwood. The pasture as a whole will rate about the average of the pastures being used on the ranch, but will rate at only three-fourths as good as our best pastures.

I should like to call your attention to the table:

Pasture	A.U. per sec.	Calf wt. over	Calf wt. per sec.	Calf wt. per sec.	Calf wt. per sec.
Pasture 15	6	30	145	155	2750
College Ranch	6	30	150	105	2450
Average of 25 sec	10	30	145	105	1475
New Mexico ranches	10	30	145	105	13000
Pasture 15 1/2	6	30	145	105	2750
Stocked to full carrying capacity	6	30	145	105	2750

* These are from actual records kept by ranchmen who are cooperating with the College in an economic study.

The first line of this table presents the actual results obtained in this pasture over the last three years. It is realized that this is better than one could expect from an entire herd in which the cows ranged in age from three to ten years old.

The second line gives the results for the College Ranch herd where the calf crop is 90 percent, the weight per section being 25 pounds less. It is unfortunate that actual figures of production from a group of ranches located in a similar type of country and rainfall are not available, with which to compare the production of the College Ranch. The best is a good possibility to be in comparison it with groups of ranches located in similar sections New Mexico, where they receive from 2 to 3 inches more annual rain-

fall. The best lands in southeastern New Mexico are able to carry, on the average, 50 percent more stock than the best lands in this section. Another factor which enters into the comparison is that ranchmen in this study do a considerable amount of winter feeding of cottonseed cake to their breeding herds. It has been found here that it is not necessary to feed the breeding herd on properly stocked black grama range. The ranches in this study, as you will note in the third line of the table, are stocked with 16 animal units per section. The stocking in this pasture is only $37\frac{1}{2}$ percent of that, and yet the production is 62 percent as great. The largest differences show up in the weight per calf and in the weight of calf produced per breeding cow. The ranches are able to produce only three-fifths as much weight per breeding cow as is the Colloge Ranch. What does this mean? It means that these ranches are allowing too great a percentage of their range feed to go into the maintenance of the breeding herd when this feed should be going to produce salable beef.

As you will note in the table, these ranches are carrying sixteen breeding cows to the section. These cows average a little over 800 pounds in weight, which makes about 13,000 pounds of breeding cows to be maintained per section before any grass is available for the production of calves. Even if pasture 15 was stocked to its capacity, each section would be called upon to maintain only 9,000 pounds of breeding cows, or 70 percent of the weight being maintained per section on these ranches. Yet at this stocking it would produce almost as many pounds of calf per section. Thus in pasture 15 a larger percentage of the grass is going into calf production and less into maintenance than in the case of the thirty-two ranches in southeastern New Mexico.

The last line of the table shows what this pasture would produce if it were stocked to full capacity. The calf weight per section would compare very favorably with that of the ranch group, being less than 7 percent under it. This difference could, without doubt, be attributed to the practice on the ranches of feeding cottonseed cake to the breeding herd, an expense not incurred here.

Now, this pasture would probably not be stocked at full capacity, as it does not have as good a stand of grass as it is able to support. To allow the stand to increase and to provide about a two months' reserve of feed above the reserve allowed for the maintenance of the grass cover, the stocking would probably not be over eight head per section in this pasture. On the other hand, the full capacity of the best black grama pastures on this ranch is considered to be twelve head per section; with an allowance of two months' reserve feed for drouth, the stocking would be ten head per section. At this rate of stocking and with the percent calf crop obtained for the entire Colloge Ranch herd, the production of calf per section would closely approximate that of the thirty-two southeastern New Mexico ranches. With their higher rainfall, and consequently higher carrying capacity, these ranches should be able to produce from 25 percent to 50 percent more weight than this ranch could. They are not doing it. Too much of their grass is going into the maintenance of unproductive cows, as indicated by the percentage of calf crop and calf weight per cow, and not enough into the production of beef for sale. This lack of grass cannot be made up for by the feeding of cottonseed cake, alfalfa, or grain sorghums, because of the expense. The ranchman who uses these feeds cannot compete with the ranchman who produces his beef on good grass alone. To sum up, the maintenance of a good range cover will pay.

The foregoing discussion is based on the presumption that ranching is a long-time enterprise. It is believed that the maintenance of a cover at the maximum possible under the rainfall and soil conditions will allow the maximum

production of salable beef over a long period of years. There is no doubt whatsoever but that an enterprising rancher could take such a ranch as this, in near virgin condition, and make it produce a very large amount of salable beef per section--for a short period of years. He would make lots of money and would no doubt be regarded as a successful ranchman. After a few years his pastures would run out and he would find it necessary to sell this ranch and secure another with better grass on it, if he was to be able to keep up his high rate of production. Just this has been done in the past when grass was free and later when it was very cheap. At present, ranges in near virgin condition are hard to find, and when they are located they are hard to buy. From now on ranching is going to have to be conducted on a long-time basis, and if maximum production is to be maintained, a good range cover will be essential.

Where a good range cover is maintained, ranchmen find that the stability of their enterprises is increased. Those who now use up all their forage in good years are, with the appearance of a drouth year, forced to buy expensive supplemental feed, to reduce their herds, often at a sacrifice, and usually in doing this incur a debt on their business. By maintaining a good range cover with a reserve for drouth, the blow is cushioned. With the extra feed on hand livestock can be put in fair condition and marketed without any particular sacrifice, and the use of supplemental feed is so curtailed that no large financial outlay is necessary. The stability of the enterprise is therefore much increased.

Incidental to these benefits from maintaining a good range cover, losses from poisonous plants are reduced. Although a large number of such plants occur on the College Ranch, there has never been losses from them. The presence of a large amount of grass prevents these plants from ever becoming very abundant on this range. Repeated experience in the testing of each new poisonous plant on livestock indicates, with few exceptions, that they are unpalatable to grazing animals. Thus when there is an adequate supply of forage on the ground, grazing animals seldom touch the poisonous plants.

Also in this connection it has been found that where a good cover of grass is maintained by proper stocking, many of our so-called range weeds do not have a chance to become a pest. The seedlings of these weeds are not able to compete with the grass for moisture, and thus are killed before they have a chance to get started. Experiments in other states have supported this view and at a stop later this morning you will have a chance to see an excellent demonstration on this point.

Lastly, the maintenance of a good range cover will prevent excessive erosion. Note I said excessive erosion. Erosion is a natural process and has gone on from the beginning of time. It is not even desirable, probably, to prevent all erosion. Excessive erosion is taking place when the soil is washing or blowing away faster than it is formed. In the past, soil has formed faster than it eroded away, otherwise there never could have been any soil. When your range cover becomes so depleted that the soil erodes away faster than it is formed, you may be slowly but you are surely destroying your basic resource. If you are going to have a productive ranch to pass on to your son when you are through, instead of a ranch with only part of its original soil cover and consequently only part of its original productiveness, it behooves you to maintain a good range cover.

If the points made in this discussion are considered to have merit, what can the ranch owner do about it? One thing he can do is to have an appraisal made of his ranch by one of several governmental agencies as to what they consider its proper carrying capacity. Or in case he does not care to sign up

with one of these programs, he can, with an inspection of areas, that have been surveyed and a comparison with his own range, arrive at some kind of a starting point. In any event, whatever the figure set to start with, it can be checked on several points each year to follow. These points are: (1) Is there a reserve of feed left at the end of the grazing season, that is, when the main growth of grass starts for the next year's crop; here we consider that to be July 1; (2) Does the calf crop come up around 90 percent; (3) Do these calves weigh 450 pounds by the time they reach seven to eight months of age? If they do not, the first figure set as the carrying capacity was too high and should be lowered accordingly.

On ranches that have been overgrazed in the past, recovery is going to be slow, even under proper stocking. It may even cost some money in the form of lowered income due to the reduced number of stock which the land will support and still build up its soil and grass cover. Fortunately, cuts in stocking can be made at small expense when livestock prices are low, and there are but very few ranches that cannot be built up over a period of years to near their original productiveness and without materially lowering their income during the process.

MAKING THE RATE OF STOCKING MORE FLEXIBLE

P. E. Neale

We do have good years, as well as bad. Fluctuation is the rule rather than the exception. The percentage of calf crop depends on the previous year's feed. The weight of calf depends on the present year's feed. A steady percentage of calves and weight depends on a steady feed supply. A good steady supply of feed reduces supplemental feeding to a minimum. The economical use of range feed is not possible when numbers are held the same each year. If stocked on a basis of good years, there will not be enough feed in average or poor years. If stocked for an average year, there will not be enough feed in poor years. If stocked on a basis of poor years, there will be a waste of feed in average and good years.

None of these give economical use of yearly feed production. Range feed is of such a nature that an animal must have all it can consume to make economical use of it. Increasing or decreasing this amount wastes feed. If too little is available, the animal uses it all for maintenance and none is left over for production. If too much is available, the animal cannot make use of it, because each animal has a limited capacity to consume, and therefore, can make but little more production than that possible on the right amount, and the surplus feed is wasted.

Most of us agree that feed supply in general is dependent on rainfall. If we believe this, we have only to look at a rainfall chart to see what the possibilities of an erratic feed supply are.

If we held our permanent numbers of animals to the average percentage of the average rainfall, there would be nine years out of eighteen years in which we would not expect enough feed and only two years that would be exactly right. There would be eight years when there would be too much feed. The good and bad years are so far apart that holding feed over from the good years to the bad ones would not be profitable.

A far poorer plan would be to base permanent stocking numbers on extra good years, of which there are only three out of eighteen. There is, evidently, no point at which permanent numbers of stock can be set so that they will always have enough to eat and not have some waste in a large number of years.

The Southwest is particularly suited to breeding herds, because of climatic conditions and yearlong grazing. It is very doubtful if the breeding herd should or will ever be replaced completely with any other system of grazing. A breeding herd's production is most critically affected by variable feed supplies when the range is stocked so heavily that there is a possibility of a scarcity of feed in a large percentage of the years. For the most economical production year after year there must be an adequate, steady supply of feed. This would mean stocking the range with a permanent number of breeding cattle at about the 7-inch rainfall line. This would leave thirteen years when there would be feed left over or from which feed could be carried over to offset a bad year.

This extra feed has to be used if the ranching operation is to be profitable. It must be used by a class of animals that can be obtained easily and quickly and that are economical feed users and are easily liquidated without affecting the breeding herd. To date, we have found that the yearling steer

best meets all of these requirements. We have considerable numbers at hand in the fall as steer calves. Other ranchmen are selling steer calves. They are plentiful on the markets. Our figures show that they make more economical gains than that produced by the cow through a calf. There is usually a market for them at any time in the year.

Some people ask, "How do we predict good and bad years or high and low rainfall?" We do not try to do this, since it is impossible. We only bet on a sure thing, that is, we regulate our stocking after the feed is on the ground. For our ranch, this time is about now or shipping time, since our rainfall is seasonable and most feed, if any, or growth, is made from August to October and this has to last us until the next August and possibly to October. We really do then keep at least one year's feed supply ahead. This supply may be large or small, depending on the amount of growth, but what is left over at shipping time indicates whether or not steers or heifers should be kept to reduce or increase our stock numbers for the following year.

In conclusion, we try to do the following things:

1. Keep our breeding herd at such numbers that they will always have feed except in extreme droughts.
2. Estimate our next year's feed supply at shipping time in October or November.
3. Sell calves or keep calves for yearlings, depending on the amount of available feed.
4. So manage that every producing animal will have all the range feed it can consume.

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4. So manage that every productive animal will have all the range food it
can consume.

TABLE I.--COMPARING THE POUNDS OF CALF GAIN FROM ONE COW
WITH THE POUNDS OF YEARLING STEER GAIN FROM THE SAME AMOUNT OF RANGE FEED

Year	Per- cent calf crop	Wt. of each calf Pound	Lbs. calf produced per cow Pound	Wt. of yearling steers Pound	Gain of yearling steers Pound	Grazing ratio - Cows to steers	Number steers grazed on feed for one cow	Steer gain on one cow's feed Pound	Value of calf at 8¢ per lb. gain Cents	Value of steer at 7¢ per lb. gain Cents	Selling price of one pound calf to equal steer Cents
1936	60	445	267	697	356	1-.605	1.65	587.4	21.36	41.12	15.4
1937	95	462	431.9	785	341	1-.64	1.56	531.96	34.55	37.24	8.6
1938	97	440.2	427	799.8	337.8	1-.55	1.82	614.76	34.16	43.03	10.07
1939	91	442	402.2	826	386	1-.65	1.54	584.44	32.17	40.90	10.06
Av.	85.7	447.3	382	776.9	355.2	1-.61	1.52	579.64	30.56	40.57	11.03

TABLE II.--BREEDING HERDS COMPARISON
ONE SELLING ALL CALVES WITH ONE SELLING YEARLING STEERS

	No. cows to calve	No. calves raised		No. calves to sell		Weight of calf sold		No. yr. st.	Wt. yr. steers	Wt. cull cattle sold	Total wt. sold	Value of wt. produced *
		St.	Hf.	St.	Hf.	Steer	Heifer					
Breeding herd steers sold as calves	160	68	68	68	42	30260	18690	0	0	25000	73950	\$4729.10
Breeding herd steers kept	134	57	57	0	35	0	15575	57	43434	21000	80009	\$5188.06

*Steer calves .08 per pound, steer yearlings .075 per pound, heifer calves .07 per pound,
cull cows .04 per pound.

TABLE III.--GAIN OF YEARLING STEERS PASTURED
WITH COWS COMPARED TO STEERS PASTURED BY THEMSELVES

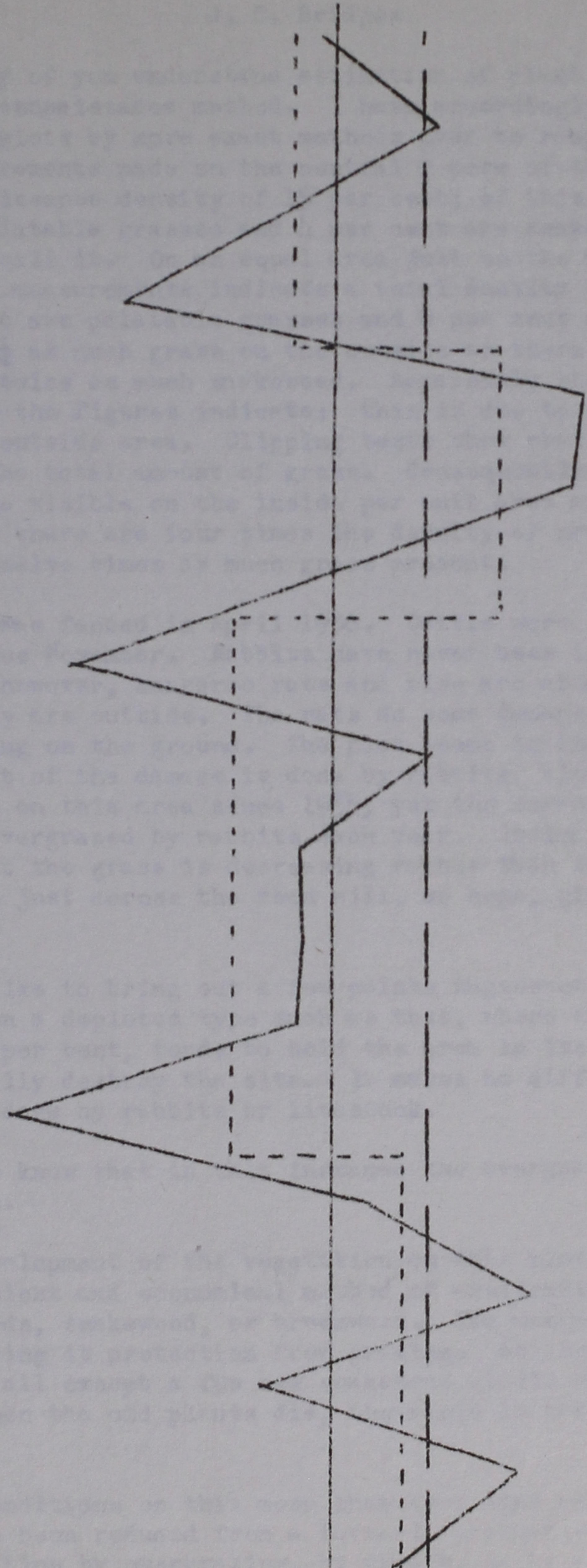
Years	1937	1938	1939	Average
Gain of steers with cows, lbs.	330	334	387	350.1
Gain of steers by themselves, lbs.	341	337	386	354.6

1920 1921 1922 1923 1924 1925 1926 1927 1928 1929 1930 1931 1932 1933 1934 1935 1936 1937 1938

Inches

Rainfall for 18 years.

16 .
15 .
14 .
13 .
12 .
11 .
10 .
9 .
8 .
7 .
6 .
5 .
4 .
3 .
2 .
1 .
0 .



— Average rainfall
- - - 25 percent below average or breeding herd level
. . . Levels of stocking caused by variable rainfall

RODENTS AS A FACTOR IN THE REVEGETATION OF BADLY DEPLETED RANGES

J. O. Bridges

A good many of you understand estimation of plant cover on the ground by the range reconnaissance method. I have accordingly changed measurements on these plots by more exact methods over to range reconnaissance figures. Measurements made on the central $\frac{1}{4}$ acre of this plot indicate a total reconnaissance density of 15 per cent; of this 15 per cent, 11 per cent are palatable grasses and 4 per cent are snakeweed, or broomweed, as some of you call it. On an equal area just to the west and outside of the plot the measurements indicate a total density of 11 per cent, of which 3 per cent are palatable grasses and 8 per cent are snakeweed. Thus there is about $\frac{1}{4}$ as much grass on the outside as there is on the inside, while there is twice as much snakeweed. Apparently there is a greater difference than the figures indicate; this is due to the heavy grazing of rabbits on the outside area. Clipping tests show that rabbits have eaten two-thirds of the total amount of grass. Consequently, there are three times the forage visible on the inside per unit area as there is on the outside. Since there are four times the density of grass on the inside, there is thus twelve times as much grass present.

This plot was fenced in April 1936. Cattle were removed from the area the previous November. Rabbits have never been in the plot since it was fenced; however, kangaroo rats and mice are about as numerous in the plot as they are outside. The rats do some damage, as you can see by the tops lying on the ground. The plot seems to indicate that much the greater part of the damage is done by rabbits alone. Cattle have not grazed on this area since 1935, yet the surrounding area has been severely overgrazed by rabbits each year. Indications from quadrat studies are that the grass is decreasing rather than increasing. A new series of plots just across the road will, we hope, give us this information.

I should like to bring out a few points suggested by this plot. First, heavy grazing on a depleted type such as this, where the grass density is less than 5 per cent, tends to hold the area in its depleted state and may eventually destroy the site. It makes no difference whether the overgrazing is done by rabbits or livestock.

Second, we know that in this instance the overgrazing has been done by rabbits.

Third, development of the vegetation on this plot strongly points to a very efficient and economical method of eradicating one of our worst range weeds, snakeweed, or broomweed. The method--give the grass a chance by giving it protection from grazing. An increased stand of grass prevents all except a few new snakeweed plants from even getting a start; thus, when the old plants die, the range is pretty well rid of snakeweed.

Fourth, conditions on this mesa show that some areas on our present-day ranges have been reduced from a formerly productive to an almost worthless condition by overgrazing, by drouth, or by a combination of the two. We do not know how this area got into this condition, but we do know it is this way and we do know that overgrazing by rabbits is keeping it in this condition. The results of protecting this one-acre plot indicate that total protection from grazing will restore it to its formerly valuable condition.

Of what practical value is this knowledge? For one thing, I believe some operators might profit by reducing their stocking on their poorer ranges, that is, on ranges that are not too poor. Each ranchman will have to use his own judgment as to whether or not the range is good enough to expect improvement if given some degree of protection from livestock. If the grass density is less than five per cent and the area is somewhat brushy, no improvement can be expected by protection from livestock only; however, if the area is not too brushy or if the grass density is 10 per cent or over and yet is less than half what it should be, considerable improvement should accrue from protection from livestock. This protection need not be 100 per cent, but may be only 50 per cent, that is, the poorer pastures if stocked at half their capacity can be expected to show considerable improvement in two or three years of normal precipitation.

Infestations of snakeweed which are occupying areas of formerly good grassland can be returned to grass by reduced stocking. If this plot shows anything, I believe it shows that grass will kill snakeweed.

Rabbits, and especially jack rabbits, are a serious range pest, at least on the lower grades of range land, and it behooves ranchmen to do what they can to reduce the numbers of them on their ranges. Continuous shooting will help. Protection of their natural predators, such as hawks, eagles, and coyotes, will also help where the predators are not harmful to the livestock.

WATER SPREADING STRUCTURES IN RELATION TO RANGE MANAGEMENT PRACTICES

V. M. Lee, Senior Range Technician
Soil Conservation Service

During the past few years water spreading has become one of the most popular and effective erosion control and, incidentally, feed producing measures that has been attempted on western range lands.

Natural water spreading is as old as time itself but artificial spreading is comparatively new. Only in the last few years, however, has man realized the importance of either enough to undertake to aid nature in her fight to preserve and rehabilitate her intricate system of spreading methods. This is being accomplished primarily by resorting to better range management practices supplemented occasionally by the construction of artificial spreaders.

By far the most effective means of spreading water is by maintaining a good thick stand of properly used vegetation with its accompanying litter and debris that, under the proper system of management, is allowed to accumulate on the ground surface. The vegetation plus this debris tends to form thousands upon thousands of minute spreading systems that check the flow of water and forces it back and forth over the ground surface, thereby, allowing the soil more time to absorb it. An improved condition of the soil itself results from the formation of a soil mulch caused by the accumulation of decaying plant material. Thus the rate of infiltration into the soil is greatly increased.

Some of the ranchers here today can probably remember the time when many of their early day stock tanks caught little or no water because of the effectiveness of nature's spreading system. At present, some of these tanks or others in these same drainages are continuously in danger of washing out or silting up, but if large enough, can be depended on as reliable water supplies. Many of these men can also look back to the time when they drove cattle and horses up and down or across these same drainages. Now, in many cases, this is impossible because of the existence of great washes, some of which vary from 10 to 30 feet deep and from 50 to 100 feet wide. The value of the millions upon millions of gallons of water that was formerly held on the ranges but is now escaping by way of these large washes is difficult to estimate in dollars and cents but the loss is so great that in many cases it means the difference between a thrifty ranching enterprise and one which the bank will probably take over. The importance of water conservation on range land can hardly be overemphasized. Dickson of Spur, Texas station stated that in a drought year when only eight inches of rain fell, a normal growth of grass occurred when the runoff was reduced from eighty percent, about normal, to sixty percent. Also, at the recent Grass Land Conference, it was brought out that on the Plains Country, seventy percent of grass available for grazing grew on thirty percent of the area - that is, certain favored places where water spread grew a large percent of feed.

The old axiom, that an ounce of prevention is worth a pound of cure, can be applied to water spreading as well as it can to other situations. If water can be held where it falls, not allowing it to accumulate in uncontrollable and devastating amounts, the returns by so doing are of much greater value than when trying to stop it and spread it just before it gets away. This, however, is the situation which we face in our conservation work today. Because many areas have lost their ability to hold back and spread the waters due to decreased and thinning stands of vegetation we are forced to resort to artificial methods in an attempt to salvage as much water as possible.

An artificial spreading structure of any type cannot be considered permanent, but is only a means to an end and that end is to re-establish the vegetation sufficiently for it to carry on the spreading work after the structure itself has lost its effectiveness.

Any type of artificial spreading structure, whether it be of rock, brush, wire and brush, earthen dike or gradient furrow, is expensive, and compatible to the grazing value of the average land in this section of the country no extensive amounts can be put in and still give the returns necessary to offset the cost of construction. Therefore, this type of treatment should be resorted to only in cases where individual situations might warrant the necessary expense of building a structure to save a piece of high carrying capacity land that is in danger of washing away or by diverting water to a tract of unproductive land which could be transformed into a high feed producing area by the aid of additional water.

Due to the numerous factors such as type of structure, purpose of treatment, size of area, and type of vegetation involved in various types of spreading areas, no set rules can be used as a guide for range management practices. Generally, however, much care should be exercised not to overgraze and trample the areas to such an extent that the purpose for which the spreader was built is nullified. Spreading areas are ordinarily the concentration point for large numbers of stock during the early spring and summer months when early floods have been of sufficient volume to start plant growth. In critical cases, where the erosion is active and the vegetation is lacking in density and vigor it may prove worthwhile to exclude stock for an indefinite time by means of fences. In other cases the fence may be removed after the vegetation has recovered sufficiently to withstand light grazing. The exclusion of stock by deferred grazing may be all that is necessary in other instances. Any use of such areas is largely dependent upon the type of vegetation involved. Flood plains covered by sacaton, tobosa, panicum or Johnson grass can be grazed only during the early spring or summer months if the greatest amount of benefit is to be derived from the feed. These grasses withstand heavy grazing and under proper use ordinarily leave enough of the plant remaining to revegetate and at the same time control erosion. On the other hand grama grass areas afford feed that is highly palatable during both the summer and winter months. Continuous heavy grazing of this type of grass during the early spring and summer may lower the plant vigor to such an extent that it is killed out, thereby subjecting the area to forces of erosion. Late fall or winter use would, therefore, be preferable for this type of area.

WHY THE PALATABILITY OF SOME OF OUR RANGE GRASSES FLUCTUATES SO MUCH DURING THE YEAR

W. E. Watkins

There is some factor or factors that cause cattle to stop eating one grass and immediately start grazing another. At other times cattle will not eat certain weathered grasses and will nearly starve when there is a fair amount of cured forage on the ground. At certain times cattle graze the weeds when there is green grass available. The answer to these and many other questions may be made clearer by a study of some of the factors that may make a feed palatable.

What is meant when we say a range forage is palatable? Palatability is influenced by a number of factors which determine the degree that an animal likes or dislikes a certain forage. These likes and dislikes are discovered by finding the particular plants and the amounts of each that are consumed. It is assumed that the livestock would not be forced or starved to eating certain forage, but would have an opportunity to select and choose one over the other. Livestock must have palatable feed if it is to consume enough to put on best gains. Palatable feeds are usually good nutritious feeds, and with a shortage of feed, it is usually of poorer quality and unpalatable.

We shall enumerate several of the factors that may influence the choosing and consumption of forage. The moisture content of a forage is one of the factors that may induce cattle to consume more. Green feeds are high in water content. Feeds with a high moisture content are succulent, and their palatability is much better than with good feed at maturity, or very much better than that of cured dry feeds.

The ash content of forage may influence palatability. With the range grasses this influence may be very slight, but with some browse plants whose mineral matter is quite high, the palatability may be greatly reduced because of this high concentration of bad-tasting, ash constituents.

Protein contributes very much to palatability. Most protein feeds are very palatable. Good green grass is rather high in protein, in comparison with the other nutrients. A high percentage of digestible protein may indicate high palatability and also excellent feeding value. The protein values change more than those of any other nutrient, with the highest values occurring during the early growing period and the lowest values after leaching and weathering have occurred.

The fat of a plant is one of the most important influences affecting palatability. Along with the true fats, there are certain alcohols, ethers, and other compounds that contribute flavor, odor, and aroma. Many of these form basic and important parts of perfumes. These pleasant smelling and tasting compounds contribute much to the palatability of our feeds. Most of these improve the taste of feed, while with some of our desert browses they may make the taste of the feed undesirable. These compounds are very high in young plants, lower in mature plants, and very low in those which have been weathered. These compounds are readily destroyed by heat and sunlight, so that in weathered grass they are very low. In the curing of alfalfa hay, the pleasant odors are some of these compounds that are being driven off and lost. A dry, weathered roughage may thus not appeal to the appetite at all.

Low-fiber feeds are more palatable, other things being equal, while high fiber content definitely makes them less desirable to eat. Young plants are low in fiber, mature plants are higher, and those which have been weathered

W. L. WATKINS

There is some factor or factors that cause cattle to stop eating one grass and immediately start grazing another. At other times cattle will not eat certain weathered grasses and will eagerly starve when there is a fair amount of cured forage on the ground. At certain times cattle throw the weeds when there is green grass available. The answer to these and many other questions may be made clearer by a study of some of the factors that may make a food palatable.

What is meant when we say a range forage is palatable? Palatability is influenced by a number of factors which determine the degree that an animal likes or dislikes a certain forage. These likes and dislikes are determined by finding the particular plants and the amounts of each that are consumed. It is assumed that the livestock would not be forced or allowed to eat any certain forage, but would have an opportunity to select and choose one over the other. Livestock must have palatable food if it is to consume enough to put on meat. Palatable foods are usually good nutritious foods, and with a shortage of food, it is usually of poorer quality and unpalatable.

We shall now consider several of the factors that may influence the choosing and consumption of forage. The relative content of a forage is one of the factors that may influence cattle to consume one. Some foods are high in water content. Foods with a high water content are unpalatable, and their palatability is much better than with food that is relatively dry. Very much better than that of water dry foods.

The ash content of forage may influence palatability. With the range forage this influence may be very slight, but with some range plants where mineral matter is quite high, the palatability may be greatly reduced because of this high concentration of ash content, and unpalatable.

Protein content may also influence palatability. Some protein foods are very palatable. Good green grass is rather high in protein. An exception with the other nutrients. A high percentage of digestible protein may indicate high palatability and also excellent feeding value. The protein values change more than those of any other nutrient, with the highest values occurring during the early growing period and the lowest values after maturity and weathering have occurred.

The fat of a plant is one of the most important influences affecting palatability. Along with the three other nutrients, protein, carbohydrates, and other compounds that contribute flavor, odor, and taste, that of these four, taste and important source of pleasure. These pleasant smelling and tasting compounds contribute much to the palatability of our foods. Most of these improve the taste of food, while some of our domestic breeds they may make the taste of the food unpalatable. These compounds are very high in young plants, low in mature plants, and very low in those that have been weathered. These compounds are readily destroyed by heat and sunlight, so that in weathered grass they are very low. In the range of alfalfa hay, the pleasant odors are some of these compounds that are being driven off and lost. A dry, weathered forage may thus not appeal to the appetite at all.

Low-fiber foods are also palatable. When the fiber is being digested, the fiber content of the food is much more palatable to the livestock. Young plants are low in fiber, mature plants are high, and those which have been weathered

are very high in fiber. The high-fiber and weathered feeds are low in palatability and also lower in feeding value.

Another group which stimulates the appetite are the sugars, starches, and the more easily digestible carbohydrates. The plant stores these carbohydrates more slowly and reaches its highest values at maturity. Rains and various weathering agencies may wash away some of these sugars and starches, and may thus account for much lower values in our weathered forage. The loss of some of the sugars and starches definitely lowers the desire to eat such forage. In turn, there is also a big loss in feeding value. Alfalfa hay, when nearly cured, was exposed to a 1.8 inch rain, which caused a loss of 60 percent of the protein, 31 percent of the dry matter, and 41 percent of the more easily digestible carbohydrates. It is possible that the rains do not wash out as much of the food value of the various range grasses as was the case with alfalfa, but large losses do occur.

The habits of growth and time of maturity of the various grasses control many of these factors of palatability. Dropseed grass, which starts growth early and continues growing throughout the season, is during this period fairly high in moisture and protein, high in the flavors and aromas, and is very low in fiber. This grass is quite desirable and palatable throughout the summer and fall. It is not until the midwinter that the consumption of this grass decreases. The following table gives the analysis of this grass for different times of the year.

ANALYSES OF MESA DROPSEED (SPOROBOLUS FLEXUOSUS) AT DIFFERENT STAGES OF DEVELOPMENT

	Field moisture basis	Air dry moist- ure	Ash	Crude Protein	Fat	Crude fiber	Easily digested carbo- hydrates	Ca.	P.
	%	%	%	%	%	%	%	%	%
Immature green grass	68.82	5.73	7.66	16.30	3.40	25.45	41.46	.300	.191
Immature green grass	43.00	5.00	7.42	15.93	2.89	26.94	41.83	.465	.151
Grass near end of growth	41.23	5.61	5.61	10.80	1.41	29.63	46.94	.213	.152
Mature grass	39.78	6.27	5.25	7.61	1.01	28.97	50.90	.144	.129
Slightly weathered	22.80	4.65	6.76	6.86	.97	33.58	47.18	.268	.075
Severely weathered and leached	15.44	5.40	5.29	3.57	.64	39.93	45.17	.114	.025

These samples were dried until they contained only about five percent moisture and then analyzed. The immature green grass, when dried, is very high in protein and low in fiber. The mature grass has a fair amount of protein and is a valuable carbohydrate roughage. The protein values decrease and the fiber increases, so that weathered grass is several degrees lower in feeding value than the straws and poor quality hays.

Tabosa is one of our poorest grasses to cure on the stalk, and also is quite low as to palatability on a year long basis. This grass starts growing early and matures early and usually stands the entire summer after maturing, subject to weathering. By fall and winter much of the protein has been washed out and a portion of the balance may be made less digestible by the action of the sun's heat. The heat has also destroyed the flavors and aroma of the plant that are so important in increasing palatability. Much of the easily digestible carbohydrates may have been washed out, leaving an unpalatable food which is high in fiber. At this stage, tabosa grass may be several degrees lower in feeding value than wheat straw. Tabosa grass, according to chemical analysis during the growing stage, has approximately the same feeding value and palatability as many other grasses, but once this stage is past both of these values

decline rapidly and the full value of the forage is lost.

What can be done to improve the situation? Many ranchmen are recognizing the problem and meeting it by proper range management. This paper is designed to emphasize the importance of grazing an early-maturing grass while it is palatable and growing and before many of the palatability and nutrition factors are destroyed. Some grasses contribute best their share in the early spring, others contribute best throughout the growing season, while others may make their contribution in the fall and through part of the winter.

The forage crop value from year to year is dependent on growing conditions. The total vegetation produced is dependent upon density of ground cover and the volume of growth. The amount of forage available is determined by the growth of the more palatable species. A luxuriant growth of unpalatable plants may give the appearance of plenty of food but does not have the same value as that obtained from the more palatable species.

On the Jornada Experimental Range, the available forage crop is determined by measuring the density and volume growth of the forage species. Usually the less palatable species are excluded from the estimate, and correction is made for the amount of forage of the less palatable species that will be consumed when the more palatable species are properly used.

These annual measurements show considerable variation from year to year, which means that the stockman must adjust his stocking to forage production or else run the risk of overgrazing in the bad years and having excess feed left over in the best years. Mr. Davis has pointed out how adjustment can be made profitably by a combination of breeding cows and steers, or by running steers alone. If operations are based entirely on raising calves, the range should be conservatively stocked so that it will not be necessary to make heavy reductions in the breeding herd during dry years.

VARIATIONS IN FORAGE PRODUCTION FROM YEAR TO YEAR

W. G. McGinnies

The amount of range forage produced is dependent upon several factors, among more important of which are (1) rainfall, (2) previous use, (3) amount of grazing during growing season, and (4) condition of the range, that is, whether or not it is run down on account of past heavy use or droughts.

The forage crop varies from year to year in response to growing conditions. The total vegetation produced is dependent upon density of ground cover and the volume of growth. The amount of forage available is determined by the growth of the more palatable species. A luxuriant growth of unpalatable plants may give the appearance of plenty of feed and lead the stockman into believing that he has more feed available than he actually has.

On the Jornada Experimental Range, the available forage crop is determined by measuring the density and volume growth of the forage species. Wholly unpalatable species are excluded from the estimates, and correction is made for the amount of forage of the less palatable species that will be consumed when the more palatable species are properly used.

These annual measurements show considerable variation from year to year, which means that the stockman must either adjust his stocking to forage production or else run the risk of overgrazing in the bad years and having excess feed left over in the best years. Mr. Neale has pointed out how adjustments can be made profitably by a combination of breeding cows and steers, or by running steers alone. If operations are based entirely on raising calves, the range should be conservatively stocked so that it will not be necessary to make heavy reductions in the breeding herd during dry years.

Another grass here is plains bristle grass (*Setaria pectinostachya*). It has done fairly well in these tests, but seems to lack an important characteristic of a good reseeding grass—that of good germination. The seed is as poor in germination that it is very uncertain whether or not one gets a stand.

Woolly love grass (*Eragrostis curvula*) did fairly well here in 1939, a very favorable year. In 1934 it was planted on 24 acres in this field and failed to make much of a showing. It is considered to be too dry for it here. In regions with more rainfall it is reported to be doing well.

All the grasses in the lower half of this field were planted in July 1939, and those in the upper half in July of this year. Last year plains bristle grass and woolly love grass were selected to test out methods of seedbed preparation and methods of planting. Since these species did not do well, we did not get much information along this line. This year brown love grass and bathurst grass were used and have furnished more positive information. There does not seem to be much difference in the stands obtained with these two species on areas prepared by double disking, single disking, harrow, or underdraining. The stands are as high as 1000 lbs. per acre in all of them, growth is perhaps not so good on the underdrained area. The underdraining was accomplished by running an underdrain

RESULTS OF RESEEDING TESTS

J. O. Bridges

Out of about 100 species of grasses tested on this ranch, only three or four are showing promise of being adaptable for this part of the State. The grass growing around the border of this field and in a $\frac{1}{4}$ -acre plot on the far side is Lehman love grass (Eragrostis lehmaniana), an importation from South Africa. This grass is a perennial, reproducing by both seed and stolons. It first came to our notice in the 1937 test plots. 1937 was a very dry year and only five other species of grasses germinated that year. Only one other species is still alive in those plots. Lehman love grass has spread to a distance of 100 ft. from the original planting, and if all the new plants were gathered together they would more than equal the original area. This illustrates one of the necessities of a good range reseeding plant; it must be able not only to hold its original area, but must be able to reseed itself naturally.

The grass in this $\frac{1}{4}$ -acre plot here is another species of love grass (Eragrostis chloremelas), and is also imported from Africa. It seems to be able to produce as good or a better stand than Lehman love grass, but it appears to be an inferior forage grass.

The yellow grass on the strip running across the field is Rothrock grama (Bouteloua rothrockii). This species is a native of Arizona and Southwestern New Mexico. It is a short-lived perennial, and as such, more nearly approaches an annual grass in its ability to germinate quickly and produce a fair-sized plant within six weeks after planting. This ability is a distinct advantage to a reseeding grass in this area, where the rains are so scattered. It has made an excellent showing this year, which is its second, but it cannot be expected to live for more than another year or two. On other smaller plots it has been reseeding itself fairly well, but seems to not be able to hold its own with the native dropseed grasses. However, if it will relieve the grazing pressure on the dropseeds for three or four years and give them a chance to get started, it will have served its purpose in range improvement.

Another grass here is plains bristle grass (Setaria macrostachya). It has done fairly well in these tests, but seems to lack an important characteristic of a good reseeding grass—that of good germination. The seed is so poor in germination that it is very uncertain whether or not one gets a stand.

Weeping love grass (Eragrostis curvula) did fairly well here in 1938, a very favorable year. In 1939 it was planted on $2\frac{1}{2}$ acres in this field and failed to make much of a showing. It is considered to be too dry for it here. In regions with more rainfall it is reported to be doing well.

All the grasses in the lower half of this field were planted in July 1939, and those in the upper half in July of this year. Last year plains bristle grass and weeping love grass were selected to test out methods of seedbed preparation and methods of planting. Since these species did not do well, we did not get much information along this line. This year Lehman love grass and Rothrock grama were used and have furnished more positive information. There does not seem to be much difference in the stands obtained with these two species on areas prepared by double disking, single disking, listing, or undercutting. The stands are as thick as is desirable on all of them, growth is perhaps not as good on the undercut area. The undercutting was accomplished by running an iron cutter bar along

about three inches under the surface; it represents the least amount of cultivation of the above mentioned methods. Harrowing with a spike-tooth harrow before planting gave a good stand, but not so good as the others. Where the seed was drilled on unprepared land the stand obtained was very poor, less than 5 per cent of what it should be. An old ditch ran diagonally across several of the plots. This was plowed shut before seeding and the results on this strip indicate that plowing would be better than any of the methods tested.

Results in 1938 and 1939 obtained with the use of a straw mulch on double-disked ground show that where some kind of plant litter is available it will be profitable to use it. It is usually not available in this area, so we have not done a great deal with it here.

Results with last year's plantings did seem to indicate that drilling with a single disk drill was considerably better than broadcasting followed by rolling with a pipe roller. This year all seeds were either drilled in or broadcast and covered with the drill. Either one appears to be satisfactory. By this method seeds seem to be planted all the way from the surface to about $1\frac{1}{2}$ inches deep, which appears to be the most desirable procedure.

One should be careful not to plant too thick; one and one-half pounds to the acre seem to be ample for such small-seeded grasses as the love grasses and the gramas, that is, where the pure seed is planted.

The forepart of July seems to be the best planting date for southern New Mexico. If planted in June and good rains bring the plants up they are likely to be killed by drouth later. If planted in the forepart of July, they are able to make use of any chance July rains and will survive till the September rains, if August happens to be dry.

To date, we have had very little luck with plantings made outside rabbit-proof areas. Rothrock grama has given fair results in one or two trials.

We do not care to make any very positive recommendations on reseeding in this part of the State at this time, for several reasons. The best grasses to date are not native and should, therefore, be grown several years to determine their behavior over a period of years. Seed is not available on the market. The College itself is much indebted to the Nurseries Division of the Soil Conservation Service for furnishing the seeds for these tests. At present they are the only source of seed for the imported species. Also, until more information is available on the control of jack rabbits, it is doubtful if it will be worthwhile to attempt reseeding.

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EFFECT OF PHOSPHORUS SUPPLEMENTS ON PRODUCTION BY RANGE CATTLE

J. H. Knox

On May 26, 1937, ten cows with calves and two dry cows were put in each of two pastures. On June 29 of the same year two yearling steers were added to each lot. In these pastures black grama and sand dropseed were the principal grasses. There were small areas of tabosa grass, some three-awn grass, and a considerable amount of mesquite brush in each pasture. Annual weeds grow in abundance over most of the area during favorable seasons.

In one lot the cattle were supplied with a mixture of 60 percent salt and 40 percent dicalcium phosphate and in the other with salt alone. The pastures were lightly stocked (about one-half of capacity), in order that no unfavorable results should be due to an insufficient amount of feed. Such a rate of stocking also insured against the chance of being forced to discontinue the test because of drouth.

The main purpose of the experiment was to study the seasonal deficiency of calcium and phosphorus in the range forage, by means of monthly analyses of blood samples of the cattle used. A report of the early phases of this study was made at this meeting two years ago. The present report will show the results of the phosphorus supplement on the amount of beef produced. The term "phosphorus supplement" is used because the results of this test substantiate those of earlier tests in showing little, if any, calcium deficiency on this range. Therefore, we feel justified in attributing beneficial results to the phosphorus feed.

The gains made by the yearling steers in each year of the test are shown in the following table. These steers had been supplied with a mixture of equal parts of special steamed bone meal and salt and had received about one-half pound of cottonseed cake daily for 120 to 150 days after weaning, about November 1st.

TABLE I -- EFFECT OF MINERAL SUPPLEMENT ON GAINS OF YEARLING STEERS

Date placed on experiment	Number of steers	Number of days on experiment	Average gain per steer - salt only	Average gain per steer - salt and dicalcium phosphate
			Pounds	Pounds
June 29, 1937	2	112	150.0	172.5
July 7, 1938	2	89	217.5	207.0
March 29, 1939	4	216	336.0	381.0
April 19, 1940 to Oct. 1, 1940	4	165	260.0	312.2

During the first two seasons, when the steers were added to the experiment about July 1, there was no consistent advantage shown for the mineral feeding. During the past two seasons, however, the gain has been consistently higher for the steers which have received the dicalcium phosphate. The most logical explanation seems to be that during the favorable season from July to November the phosphorus in the forage was not sufficiently low to deplete the storage from previous liberal phosphorus feedings. This view is strengthened by the rather high phosphorus content of forage samples taken during those months and by the fact that the only year when the gain of the non-mineral steers was as great as the gain of those receiving a mineral supplement was 1938, an unusually favorable growing season. In the 1939 and 1940 seasons the steers were on the test during the dry spring months and the longer period gave

EFFECT OF PHOSPHORUS SUPPLEMENT ON PRODUCTION BY RANGE CATTLE

J. H. Egan

On May 26, 1937, ten cows with calves and two dry cows were put in each of two pastures. On June 29 of the same year two yearling steers were added to each lot. In these pastures black grass and sand dropped were the principal grasses. There were small areas of carbon grass, some three-awn grass, and a considerable amount of mesquite brush in each pasture. Annual weeds grow in abundance over most of the area during favorable seasons.

In one lot the cattle were supplied with a mixture of 60 percent salt and 40 percent disodium phosphate and in the other with salt alone. The pastures were lightly stocked (about one-half of capacity), in order that no unfavorable results should be due to an insufficient amount of food. Such a rate of stocking also insured against the chance of being forced to discontinue the test because of drought.

The main purpose of the experiment was to study the seasonal deficiency of calcium and phosphorus in the range forage, by means of monthly analyses of blood samples of the cattle used. A report of the early phases of this study was made at this meeting two years ago. The present report will show the results of the phosphorus supplement and the amount of beef produced. The term "phosphorus supplement" is used because the results of this test substantiate those of earlier tests in showing little, if any, calcium deficiency on this range. Therefore, we feel justified in attributing beneficial results to the phosphorus food.

The gains made by the yearling steers in each year of the test are shown in the following table. These steers had been supplied with a mixture of equal parts of special steamed bone meal and salt and had received about one-half pound of cottonseed oil daily for 150 to 180 days after weaning, about November 1st.

TABLE I. -- EFFECT OF MINERAL SUPPLEMENT ON GAINS OF YEARLING STEERS

Date placed in experiment	Number of steers in experiment	Average gain per steer - salt only	Average gain per steer - salt and disodium phosphate
June 29, 1937	2	112.0	172.5
July 1, 1938	2	89.0	207.0
March 29, 1939	1	216.0	381.0
April 12, 1940	1	165.0	312.2
to Oct. 1, 1940			

During the first two seasons, when the steers were added to the experiment about July 1, there was no consistent advantage shown for the mineral feeding. During the past two seasons, however, the gain has been consistently higher for the steers which have received the disodium phosphate. The most logical explanation seems to be that during the favorable season from July to November the phosphorus in the forage was not sufficiently low to deplete the steers from previous liberal phosphorus feedings. This view is strengthened by the rather high phosphorus content of forage samples taken during these months and by the fact that the only year when the gain of the non-mineral steers was as great as the gain of those receiving a mineral supplement was 1938, an unusually favorable growing season. In the 1939 and 1940 seasons the steers were on the test during the dry spring months and the longer period gave

a greater opportunity for the effects of a low phosphorus ration to become apparent.

Table II shows the results of mineral feeding on the production by range cows. As stated above, these cows were started on the experiment May 26, 1937. At the time of weaning, November 2, the calves from the cows receiving no phosphorus supplement averaged 13.6 pounds heavier than those in the mineral lot, and all the cows got in calf during that breeding season. This is the last time either of these things occurred, as may be seen from the following table. The results obtained in the summer of 1937 indicate that the effects of a lack of phosphorus had not yet become apparent. They also show that the cows in this lot were normally at least as good producers as those in the other lot.

TABLE II -- EFFECT OF MINERAL SUPPLEMENT ON CALF PRODUCTION
(12 COWS IN EACH LOT)

	Salt Only	Salt and dicalcium phosphate
1938		
Number of calves born	12	11
Number of calves died	2	0
Average weight of calves weaned, lbs.	427.4	472.7
Pounds of calf weight per cow bred	356.0	432.9
1939		
Number of calves born	10	10
Number of calves died	2	0
Average weight of calves weaned, lbs.	467.4	490.8
Pounds of calf weight per cow bred	311.2	408.8
1940		
Number of calves born	11	12
Number of calves died (natural causes)*	0	0
Average weight of calves weaned, lbs.	407.1	446.4
Pounds of calf weight per cow bred	372.9	446.4
Average production per cow bred, lbs.	346.7	429.4

*One calf in mineral lot was killed on power line September 24, 1940

One of the dry cows in the pasture where dicalcium phosphate was fed proved to be barren. She was removed from the experiment in 1939 without ever having gotten with calf. With only one exception, all the other cows in this pasture raised a calf each year. After the 1937 breeding season, one or more of the cows in the non-mineral lot failed to get with calf. Furthermore, two calves in the 1938 and in the 1939 seasons died at or soon after birth. All these cattle had shown to be free from Bang's disease on repeated tests. Each year following 1937 the calves in the mineral group have been from about 25 to 40 pounds heavier at weaning than those from cows which did not receive the phosphorus supplement. When this lighter weight is combined with the smaller number of calves weaned, there is an average difference in production per cow bred of over 80 pounds.

The following table shows the amount of dicalcium phosphorus consumed and the amount of special steamed bone meal which would have been required to supply the same amount of phosphorus.

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Table II shows the results of mineral feeding on the production by range cows. As stated above, these cows were started on the experiment May 25, 1937, the time of weaning. November 2, the calves from the cows receiving no phosphorus supplement averaged 15.4 pounds heavier than those in the mineral group, and all the cows got in calf during this breeding season. This is the first time either of these things occurred, as may be seen from the following table. The results obtained in the summer of 1937 indicate that the effects of a lack of phosphorus had not yet become apparent. They also show that the cows in the lot were normally at least as good producers as those in the other lot.

TABLE II -- EFFECT OF MINERAL SUPPLEMENT ON CALF PRODUCTION
(12 COWS IN EACH LOT)

Lot	Mineral Supplement	Number of calves born	Number of calves died	Average weight of calves weaned, lbs.	Pounds of calf weight per cow bred
1	Lot	12	2	157.4	308.0
2	Lot	10	2	147.4	271.2
3	Lot	12	0	167.1	378.2
4	Lot	12	0	146.1	278.2
5	Lot	12	0	146.1	278.2
6	Lot	12	0	146.1	278.2
7	Lot	12	0	146.1	278.2
8	Lot	12	0	146.1	278.2
9	Lot	12	0	146.1	278.2
10	Lot	12	0	146.1	278.2
11	Lot	12	0	146.1	278.2
12	Lot	12	0	146.1	278.2
13	Lot	12	0	146.1	278.2
14	Lot	12	0	146.1	278.2
15	Lot	12	0	146.1	278.2
16	Lot	12	0	146.1	278.2
17	Lot	12	0	146.1	278.2
18	Lot	12	0	146.1	278.2
19	Lot	12	0	146.1	278.2
20	Lot	12	0	146.1	278.2
21	Lot	12	0	146.1	278.2
22	Lot	12	0	146.1	278.2
23	Lot	12	0	146.1	278.2
24	Lot	12	0	146.1	278.2
25	Lot	12	0	146.1	278.2
26	Lot	12	0	146.1	278.2
27	Lot	12	0	146.1	278.2
28	Lot	12	0	146.1	278.2
29	Lot	12	0	146.1	278.2
30	Lot	12	0	146.1	278.2
31	Lot	12	0	146.1	278.2
32	Lot	12	0	146.1	278.2
33	Lot	12	0	146.1	278.2
34	Lot	12	0	146.1	278.2
35	Lot	12	0	146.1	278.2
36	Lot	12	0	146.1	278.2
37	Lot	12	0	146.1	278.2
38	Lot	12	0	146.1	278.2
39	Lot	12	0	146.1	278.2
40	Lot	12	0	146.1	278.2
41	Lot	12	0	146.1	278.2
42	Lot	12	0	146.1	278.2
43	Lot	12	0	146.1	278.2
44	Lot	12	0	146.1	278.2
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46	Lot	12	0	146.1	278.2
47	Lot	12	0	146.1	278.2
48	Lot	12	0	146.1	278.2
49	Lot	12	0	146.1	278.2
50	Lot	12	0	146.1	278.2
51	Lot	12	0	146.1	278.2
52	Lot	12	0	146.1	278.2
53	Lot	12	0	146.1	278.2
54	Lot	12	0	146.1	278.2
55	Lot	12	0	146.1	278.2
56	Lot	12	0	146.1	278.2
57	Lot	12	0	146.1	278.2
58	Lot	12	0	146.1	278.2
59	Lot	12	0	146.1	278.2
60	Lot	12	0	146.1	278.2
61	Lot	12	0	146.1	278.2
62	Lot	12	0	146.1	278.2
63	Lot	12	0	146.1	278.2
64	Lot	12	0	146.1	278.2
65	Lot	12	0	146.1	278.2
66	Lot	12	0	146.1	278.2
67	Lot	12	0	146.1	278.2
68	Lot	12	0	146.1	278.2
69	Lot	12	0	146.1	278.2
70	Lot	12	0	146.1	278.2
71	Lot	12	0	146.1	278.2
72	Lot	12	0	146.1	278.2
73	Lot	12	0	146.1	278.2
74	Lot	12	0	146.1	278.2
75	Lot	12	0	146.1	278.2
76	Lot	12	0	146.1	278.2
77	Lot	12	0	146.1	278.2
78	Lot	12	0	146.1	278.2
79	Lot	12	0	146.1	278.2
80	Lot	12	0	146.1	278.2
81	Lot	12	0	146.1	278.2
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87	Lot	12	0	146.1	278.2
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89	Lot	12	0	146.1	278.2
90	Lot	12	0	146.1	278.2
91	Lot	12	0	146.1	278.2
92	Lot	12	0	146.1	278.2
93	Lot	12	0	146.1	278.2
94	Lot	12	0	146.1	278.2
95	Lot	12	0	146.1	278.2
96	Lot	12	0	146.1	278.2
97	Lot	12	0	146.1	278.2
98	Lot	12	0	146.1	278.2
99	Lot	12	0	146.1	278.2
100	Lot	12	0	146.1	278.2

One of the dry cows in the pasture where dicalcium phosphate was fed over to be barren. She was removed from the experiment in 1939 without ever being gotten with calf. With only one exception, all the other cows in this pasture raised a calf each year. After the 1937 breeding season, one or more of the cows in the non-mineral lot failed to get with calf. Furthermore, two calves in the 1938 and in the 1939 seasons died at or soon after birth. All these calves had shown to be free from Bang's disease on repeated tests. Each year following 1937 the calves in the mineral group have been from about 25 to 40 pounds heavier at weaning than those from cows which did not receive the phosphorus supplement. When this lighter weight is compared with the smaller number of calves weaned, there is an average difference in production per cow bred over 80 pounds.

The following table shows the amount of dicalcium phosphate consumed and amount of special stored bone meal which would have been required to supply the same amount of phosphorus.

TABLE III -- AVERAGE PER-HEAD YEARLY MINERAL CONSUMPTION BY RANGE COWS

Season	1937-38	1938-39	1939-40 to October 1
Dicalcium phosphate consumed, lbs.	9.2	11.75	12.0
Phosphorus consumed, lbs.	1.656	2.115	2.160
Amount of special steamed bone meal required to supply phosphorus, lbs.	12.55	16.2	16.46
Cost of special steamed bone meal at \$45 per ton	28.24 ~~4~~	36.04	37.04 ~~4~~
Increase in production per cow due to use of mineral supplement, lbs.	76.9	97.6	73.5
Value of increased production @ 8¢ lb.	6.15	7.81	5.88
Yearly financial gain per cow from the use of the supplement	\$5.87	\$7.45	\$5.48

When the cost of this bone meal is compared with the value of 80 pounds of annual increase in production, which resulted from using the supplement, a substantial profit is evident. This profit is increased somewhat by the fact that considerably less salt was consumed where dicalcium phosphate was fed.

Summary

1. Yearling steers which received no phosphorus supplement from April to November made about 50 pounds less gain per head than those which received the supplement. When mineral was fed until July, no important difference in gain was observed during the remainder of the summer.

2. Range cows fed dicalcium phosphate raised more calves, calves that were stronger at birth, and calves that weighed more at weaning time than cows which received no such supplement.

3. The small cost of the dicalcium phosphate was much more than repaid by the greater amount of beef produced.

4. These results were obtained during rather favorable years. It may be expected that benefits from mineral feeding will be even greater in drouth years when the phosphorus content of range forage is lower.

TABLE III - AVERAGE PER-HEAD YEARLY MINERAL CONSUMPTION BY RANGE COWS

Season	1957-58	1958-59	1959-60 to October 1
Dicalcium phosphate consumed, lbs.	9.2	11.1	12.9
Phosphorus consumed, lbs.	1.63	2.11	2.16
Amount of special steamed bone meal supplied to supply phosphorus, lbs.	12.75	15.6	14.45
Cost of special steamed bone meal at \$1.25 per ton	28.44	19.50	18.06
Increase in production per cow due to use of mineral supplement, lbs.	76.9	94.5	77.5
Value of increased production @ 8¢ per lb.	6.15	7.56	6.20
Yearly financial gain per cow from the use of the supplement	\$6.15	\$7.56	\$6.20

When the cost of this bone meal is compared with the value of 63 pounds of annual increase in production, which resulted from using the supplement, a substantial profit is evident. This profit is increased somewhat by the fact that considerably less salt was consumed when dicalcium phosphate was fed.

Summary

1. Yearling steers which received no phosphorus supplement from birth to November made about 50 pounds less gain per head than those which received the supplement. When mineral was fed until July, no important difference in gain was observed during the remainder of the summer.
2. Range cows fed dicalcium phosphate gained more weight, calved earlier and were stronger at birth, and calves like weighed more at weaning than those cows which received no such supplement.
3. The small cost of the dicalcium phosphate was much more than repaid by the greater amount of beef produced.
4. These results were obtained during winter months when the range is dry. It is expected that benefits from mineral feeding will be even greater in months when the phosphorus content of range forage is lower.

RANGE MANAGEMENT AND PRESERVATION

Fred N. Ares

The chief objectives of the 25 years experimental work on the Jornada Experimental Range has been:

- (1) To develop a plan of management which would eliminate the heavy losses of cattle due to the periodic prolonged droughts.
- (2) To increase calf crops by approved herd management methods.
- (3) To improve the general grade of livestock in order to reach the desired aim of maximum beef production and,
- (4) To reduce production costs of cattle.

These objectives in a large measure have all been met by the early adoption of a plan of conservative range use which insures not only forage sufficient to the needs of the grazing herd but in addition a reserve of grazing capacity to meet the needs of the frequent year of below normal forage growth. Losses have been reduced to less than 2% from all causes including drought and poisonous plants; calf crops have averaged 70 percent for the 25 year period of the experiment, increasing to 76 percent for the last 13 years. The conservative stocking policy has made it imperative to have only productive units in the herd and the resultant drastic culling has brought about a steady improvement in the grade of livestock. As for production costs, these have declined in direct ratio to the reduced death losses and the increased calf crops. Also the conservative system of stocking has succeeded in almost entirely eliminating costly supplemental feeding and the planned, systematic use of the range has considerably reduced the overhead cost of range improvements.

The present plan of management of the Jornada provides that the total stocking be 25 percent below the average grazing capacity of the range. The average capacity has been determined by annual utilization surveys. This 25 percent reserve provides a buffer which guarantees that except in very unusual drought years, there will not be more cattle on the range than the forage will support.

During recent years and especially since the 1934 drought the Jornada Co-operator has adopted an even more conservative alternative of the above plan of management. This consists in holding the breeding herd consisting of bulls, cows, and replacement heifers down to a point about 45 to 50 percent of the average. Then during years when forage growth conditions warrant, more cattle are brought in, usually yearlings or calves to utilize the surplus feed. This plan provides a means of quick liquidation in case of a severe drought.

The Jornada Management Plan calls for distribution of stock on the range in order that proper and seasonal use may be made of all range types. Tabosa grass, being unpalatable after the growing season, is used extensively during that period while the year-long palatable grasses, such as black grama, are reserved for winter and spring use when no temporary feed is available. This distribution is effected by fencing, by water control, and by range salting. These measures also insure fairly uniform utilization of the food so that the outlying and more inaccessible areas are used along with the range near water.

The range is closely watched at all times for any indications of deterioration in order that corrective measures may be taken in time. It is quite

Fred H. Lee

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- (4) To reduce production costs of cattle.

These objectives in a large measure have all been met by the early adoption of a plan of conservative range use which insures not only forage sufficient to the needs of the grazing herd but in addition a reserve of grazing capacity to meet the needs of the present and future range growth. Losses have been reduced to less than 25 from all causes including drought and poisonous plants; calf crops have averaged 70 percent for the 25 year period of the experiment, increasing to 75 percent for the last 15 years. The conservative stocking policy has made it imperative to have only productive cattle in the herd and the resultant drastic culling has brought about a steady improvement in the grade of livestock. As for production costs, these have been reduced in direct ratio to the reduced death losses and the increased calf crops. Also the conservative system of stocking is a successful means of eliminating costly supplementary feeding and the planned, systematic use of the range has considerably reduced the overhead cost of range improvements.

The present plan of management of the Jornada provides that the total stocking be 25 percent below the average grazing capacity of the range. The average capacity has been determined by annual utilization surveys. This 25 percent reserve provides a buffer which insures that except in very unusual drought years, there will not be more cattle on the range than the forage will support.

During recent years and especially since the 1934 drought the Jornada Experiment has adopted an even more conservative alternative of the above plan of management. This consists in holding the breeding herd consisting of bulls, cows, and replacement heifers down to a point about 15 to 20 percent of the average. Then during years when forage growth conditions warrant, more cattle are brought in, usually yearlings or calves to utilize the surplus food. This plan provides a means of quick liquidation in case of a severe drought.

The Jornada Management plan calls for distribution of stock on the range in order that proper and economical use may be made of all range types. This is accomplished after the grazing season is well extended by having the yearling and spring weaners when no supplementary food is available. The distribution is effected by fencing, by water control, and by range riding. These measures also insure fairly uniform utilization of the food so that the overgrazing and more inaccessible areas are used along with the range near water.

The range is closely watched at all times for any indications of deterioration in order that corrective measures may be taken in time. It is quite

possible on any range in the Southwest for certain small areas to receive deficient rainfall for several conservative years until even the most conservative use thereon would be overgrazing and would cause gradual damage and loss of grazing capacity.

Indicators of such disturbance and deterioration are numerous and consist always of a replacement process of the better forage species by those of lesser palatability. On black grama ranges such as the Jornada the first indication of disturbance is an increase in the amount of dropseed and three-awn grasses in the general composition. If this is caused by drought alone, recovery will be rapid. But if the condition comes from a combination of drought and overgrazing, normal composition will be regained only after a long period of careful handling.

Indicators of advanced deterioration of range are, of course, familiar to everyone. They include sheet and gully erosion as well as a noticeable increase in unpalatable shrubs such as snakewood, rabbit brush, burro weed, mesquite, and also many kinds of weeds. If the range is permitted to reach this stage it is almost too late then to take the necessary measures for correction.

For this reason it is highly important for all individuals using range to be familiar with these various signs of range disturbance so that deterioration may be detected in its early stages when remedial measures may be easily and quickly applied.

The annual surveys made for utilization and forage production on the Jornada serve as a regular check on range conditions and any areas showing disturbance are closely watched. Numerous enclosures serve as checks indicating the original condition of the range.